

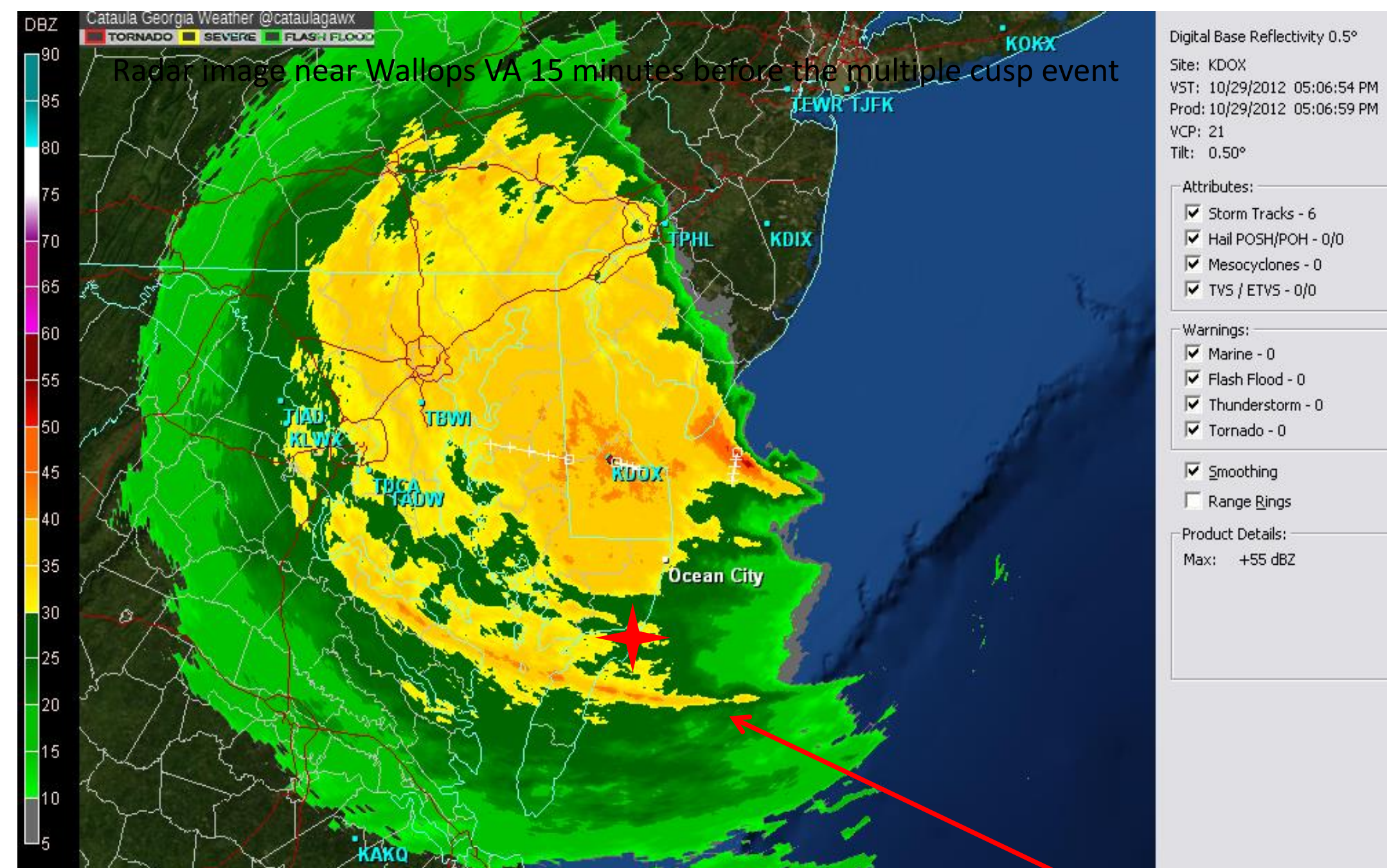
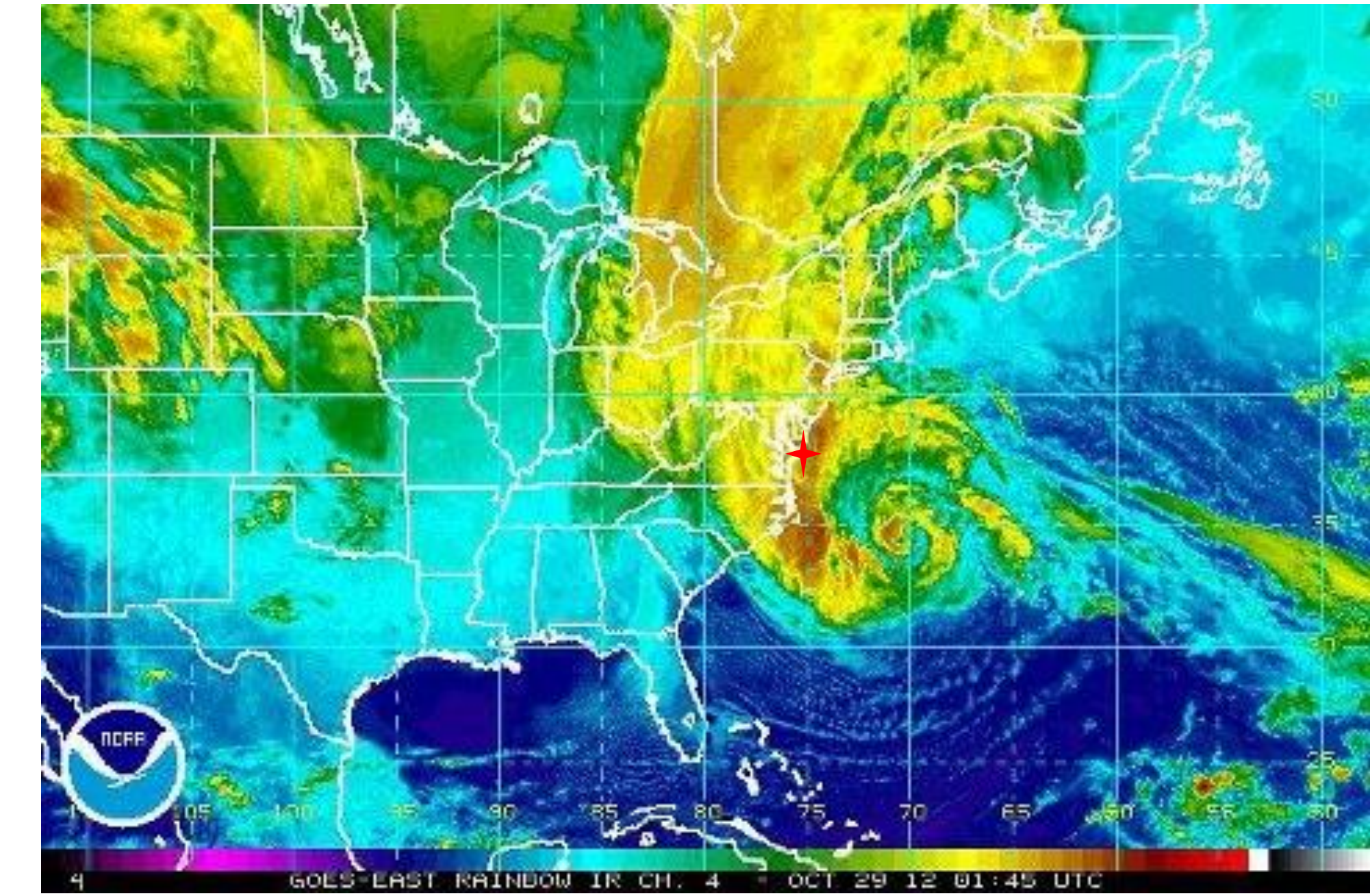
A High Resolution Observation of an Ionospheric Disturbance Over Hurricane Sandy



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ABSTRACT

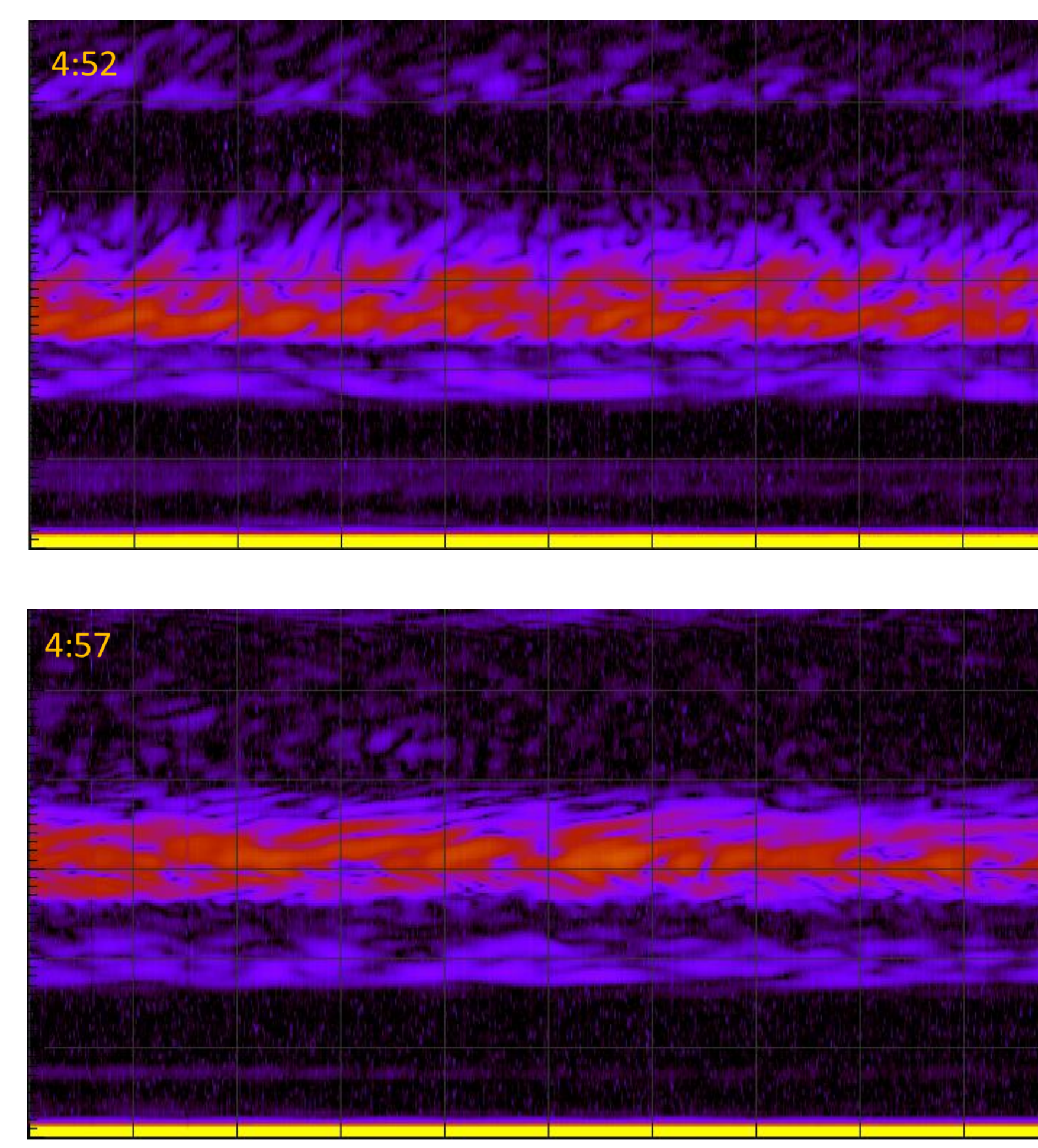
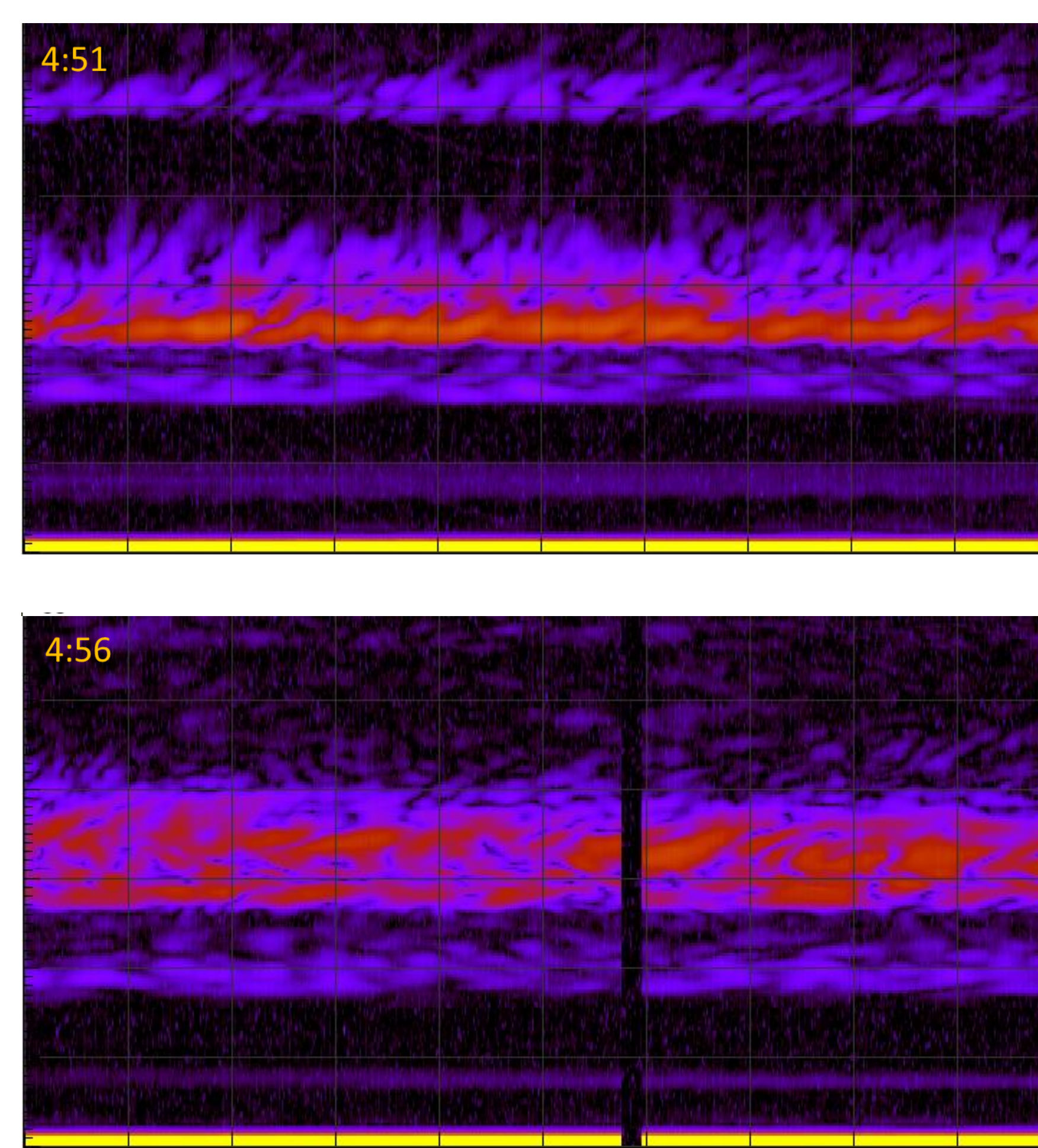
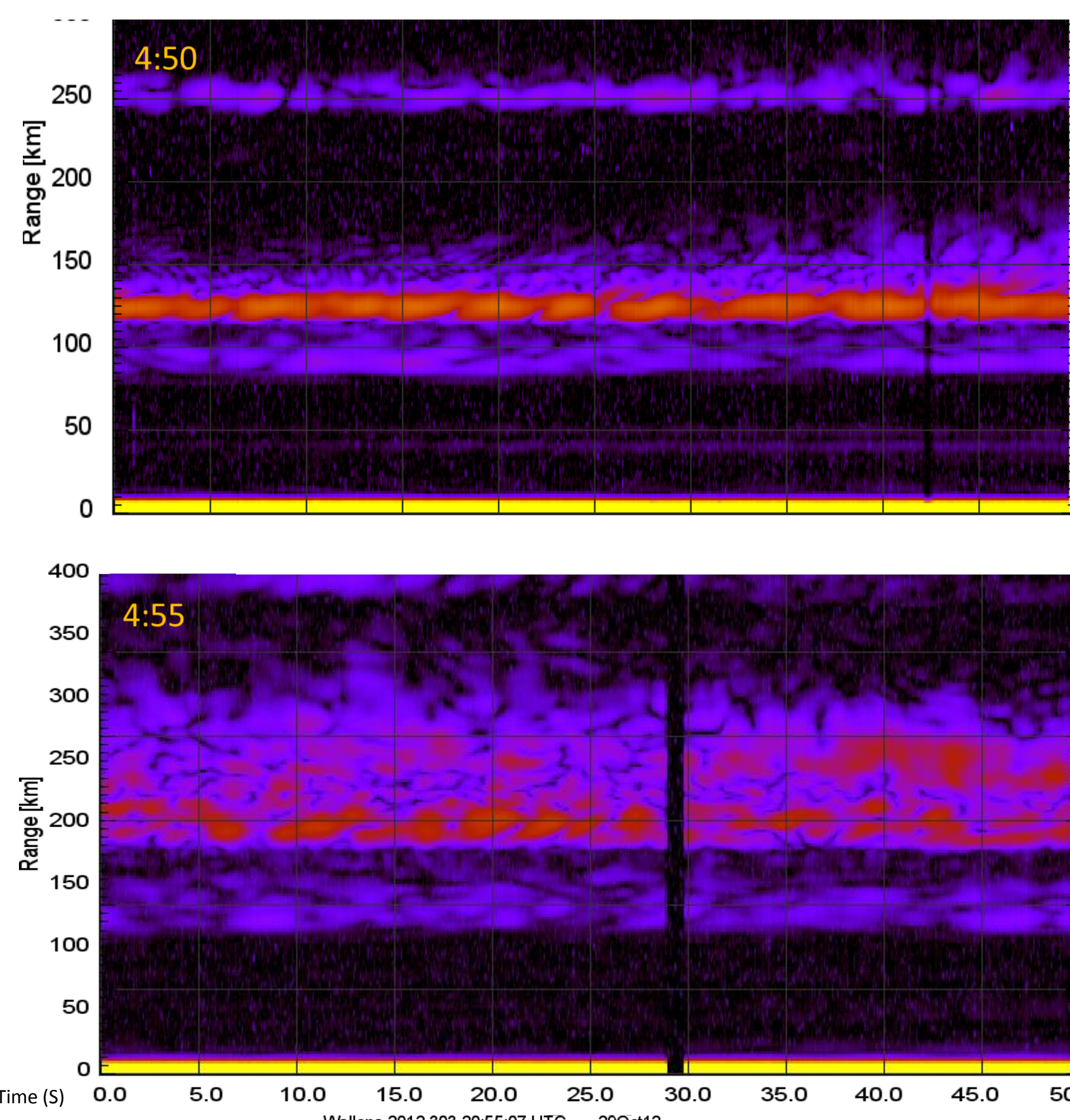
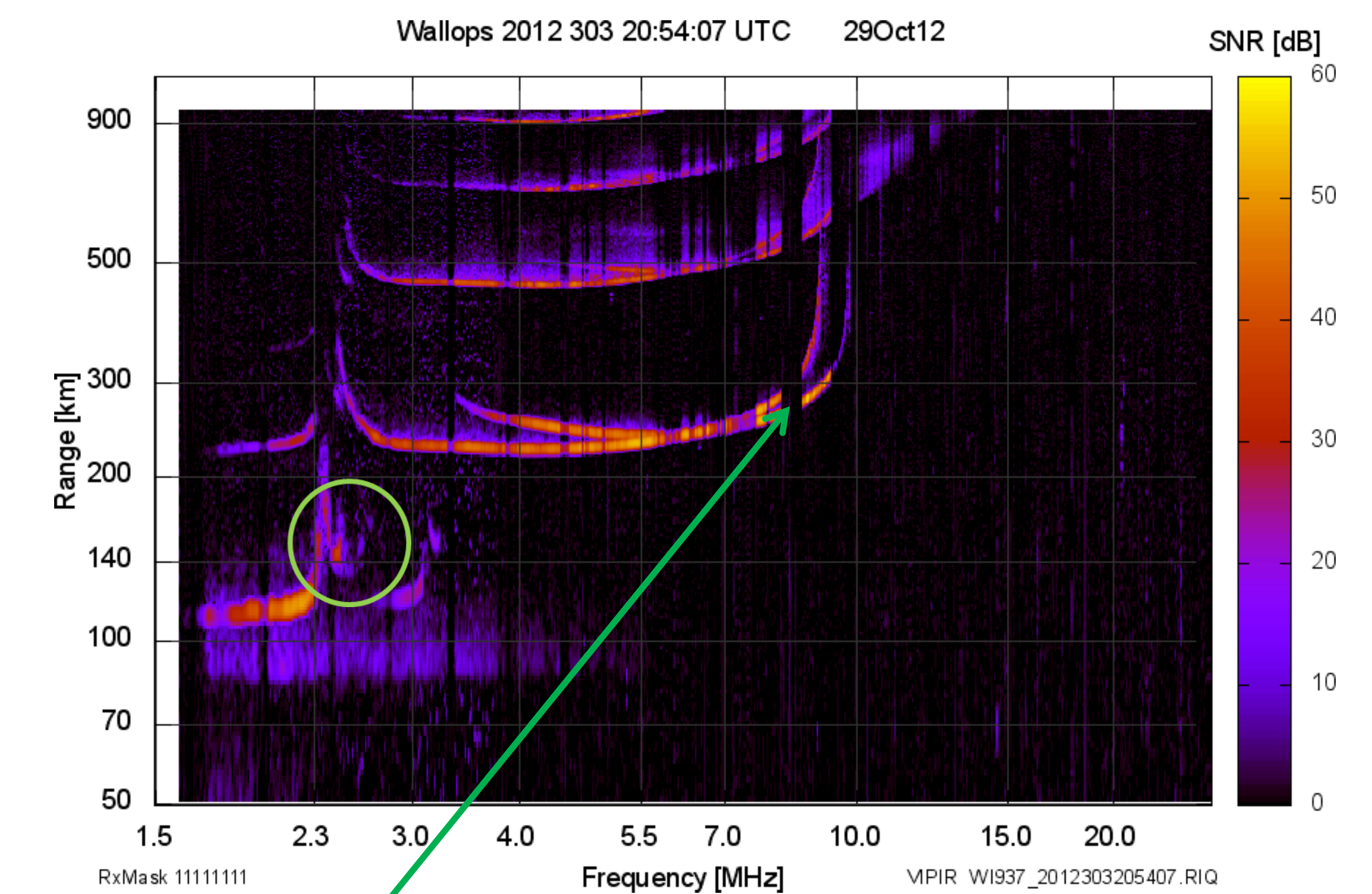
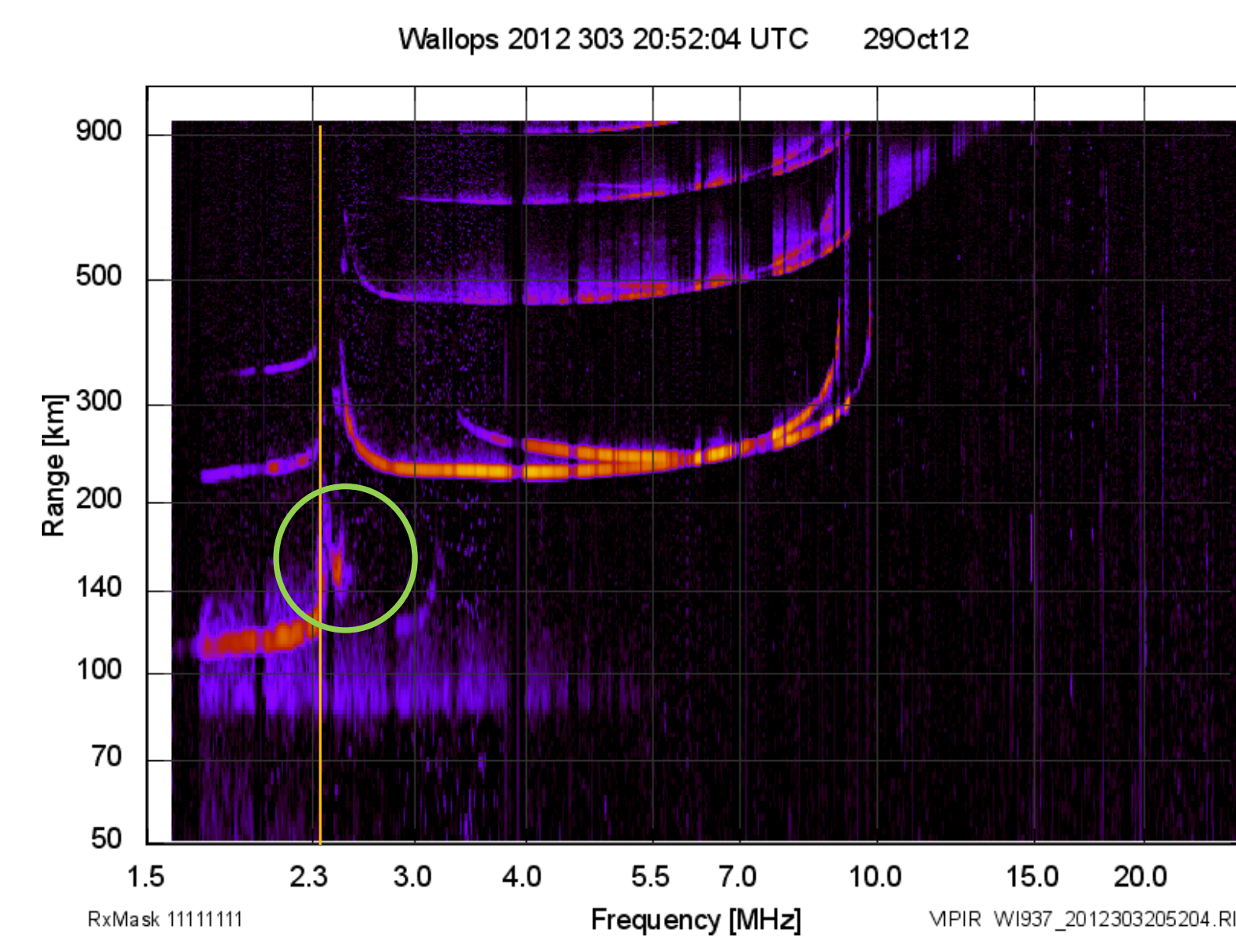
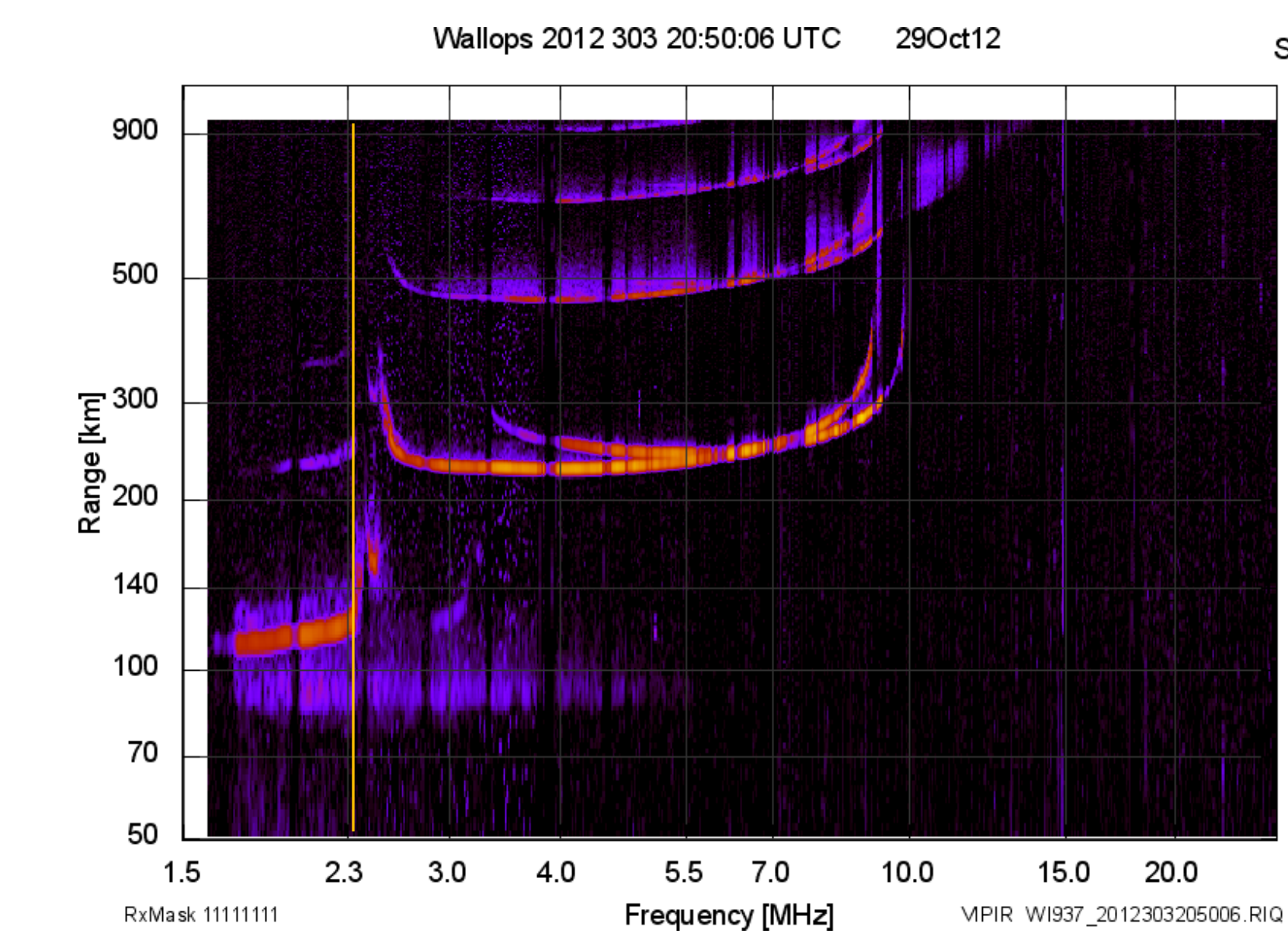
The Wallops Island *Vertical Incidence Pulsed Ionospheric Radar* (VIPIR) was set to experimental ‘shuffle’ mode before Hurricane Sandy approached Virginia’s Eastern Shore. This experiment was designed as an attempt to observe ionospheric irregularities associated with the passing hurricane. The VIPIR transmits in sweep mode between 1 MHz and 20 MHz to observe the bottom-side ionosphere, while interleaving a fixed frequency pulse mode at 2.34 MHz between each sweep mode pulse. What appears to be a gravity wave associated with a strong storm band propagates through the observation region. The resulting disturbance lowers the E-layer critical frequency (FoE) across the 2.34 MHz band. This produced a high temporal and spatial resolution observation of an ionospheric disturbance associated with a hurricane. The entire event occurs over a ten minute interval.



Radar image at 5:06 pm shows suspect storm band.

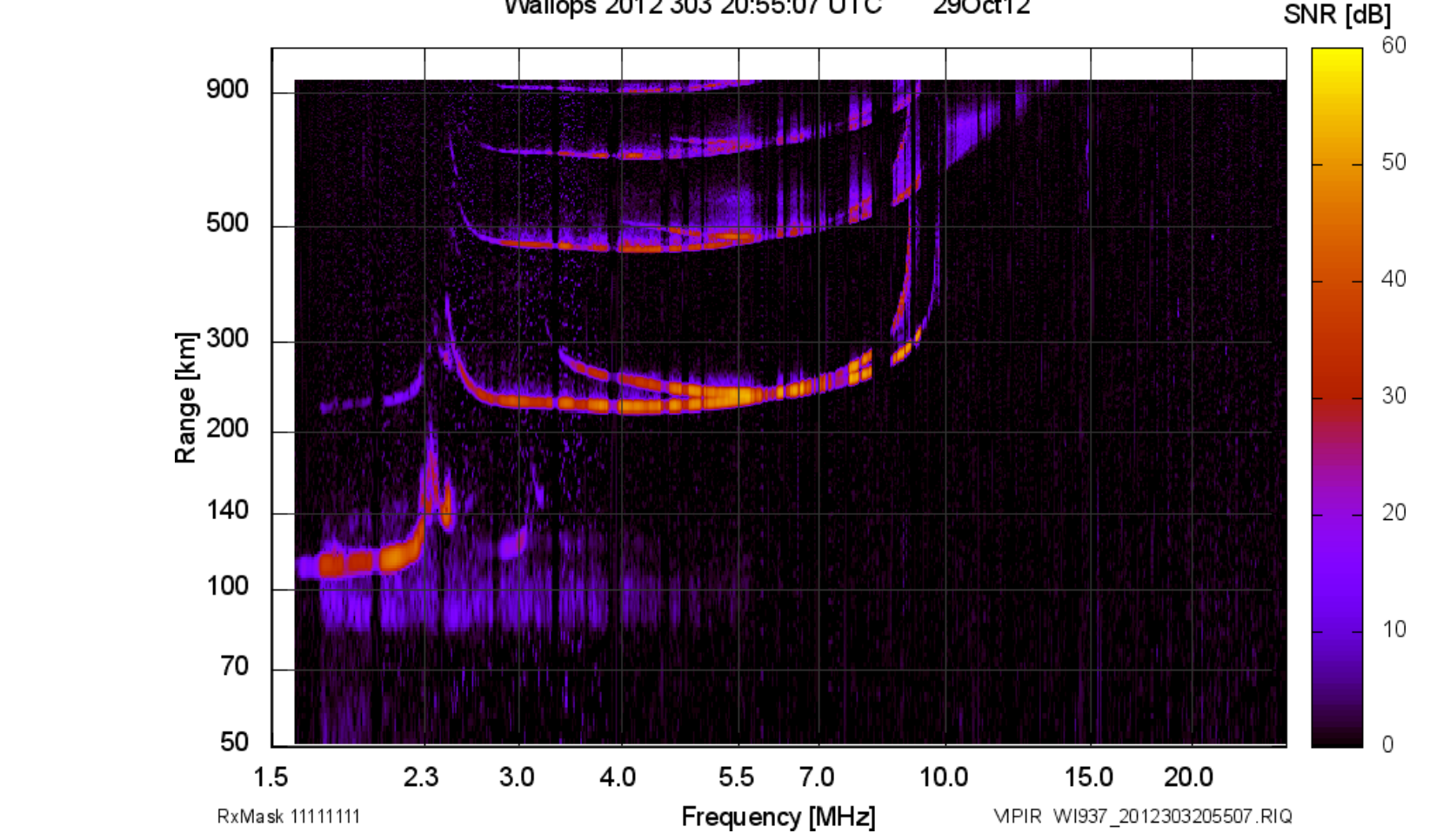
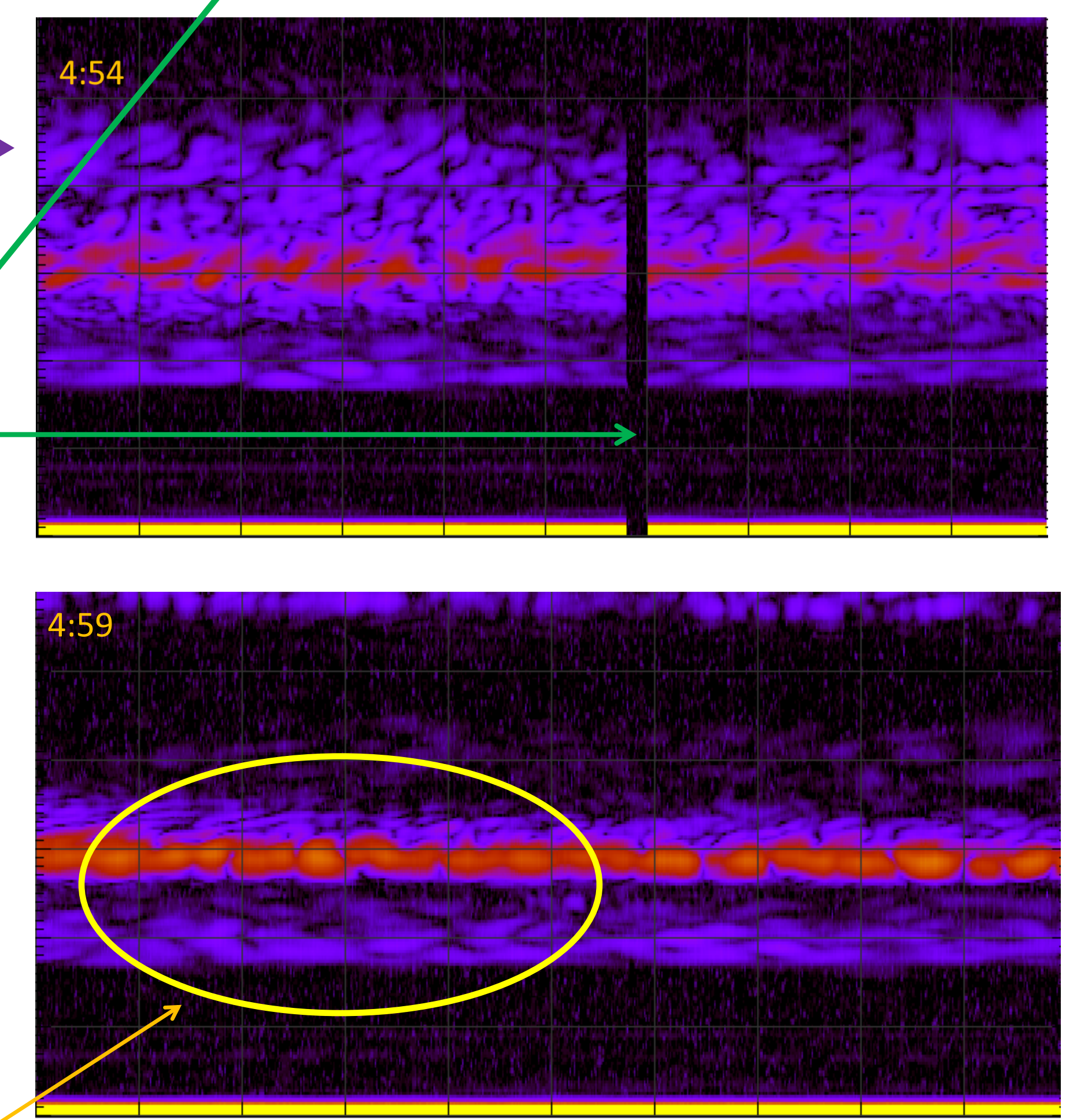
2.34 MHz dwell frequency approaches the critical frequency FoE. As FoE drops across the dwell frequency a multiple cusp region forms. Multiple cusp regions have been associated with gravity wave and acoustic wave phenomena. The apparent increase in range spread is due to the slowing of the radio wave, effectively increasing the spatial resolution of the observation.

The observed multiple cusp event begins at 4:50 and ends before 5:00. This means a normally operating Digisonde that would sound every 15 minutes at 4:45 and 5:00 would have missed this rare event entirely

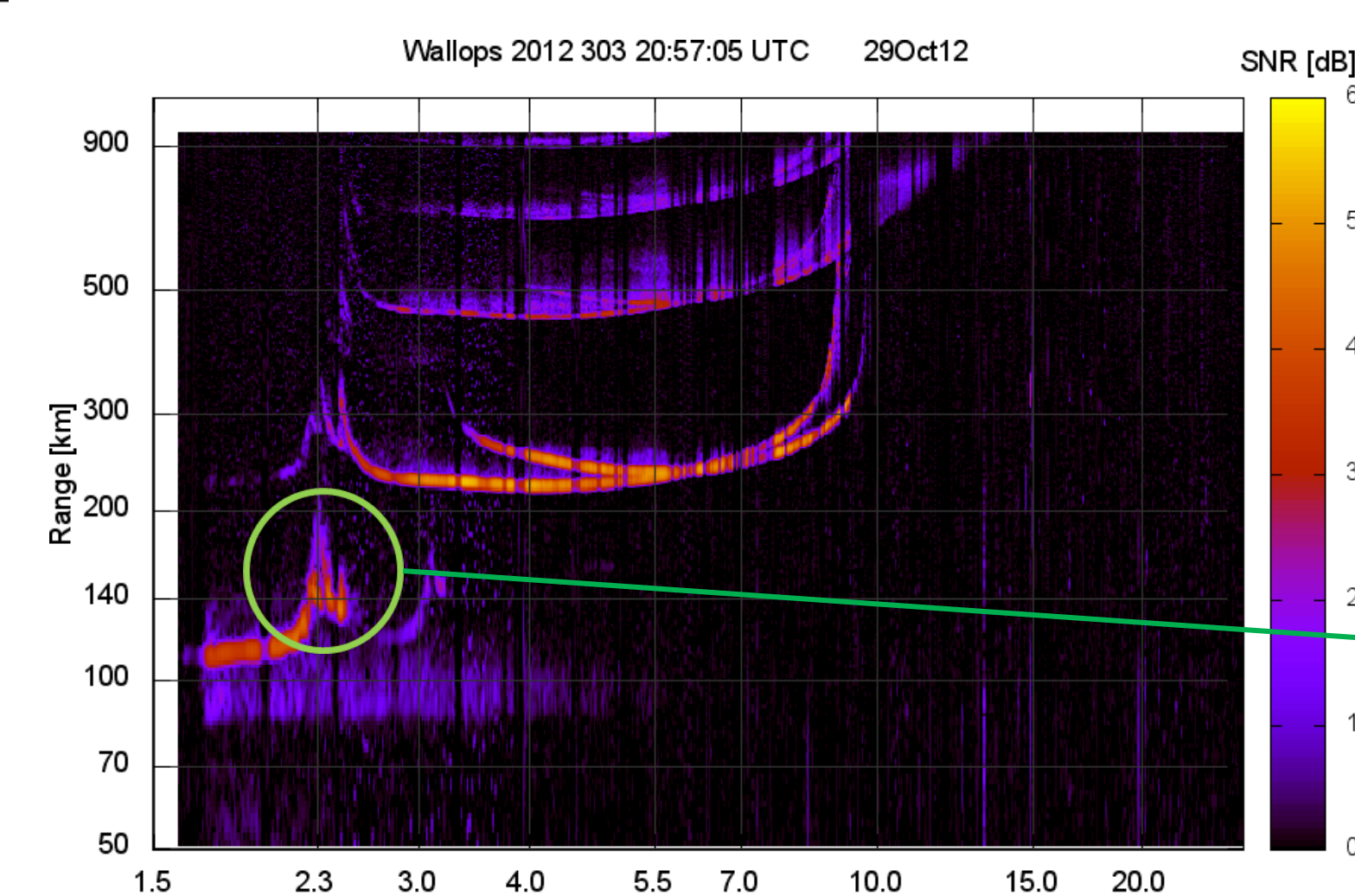


Some missing data due to conditions beyond our control

Blackened out regions are due to intermittent transmitter failures. We suspect that subsurface remnants of an old building become saturated with water and cause a high standing wave ratio (SWR) exceeding hardware limits. The transmitter shuts off for several seconds as a protective measure.



Both Wallops Ionosondes, the VIPIR and Digisonde were upgraded in September 2012. This timely upgrade allowed for the high quality of data that was collected. During the hurricane, the Digisonde failed completely due to storm damage, but operation of the VIPIR transmitter was only slightly affected.



There are many distinguishable features each of which can be a unique echo source or an ensemble of echo sources. Echo sources have physical properties that can be evaluated from further analysis of the RIQ data files.

The multiple cusp region settles out after several minutes.

